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MARKET AND COST STRUCTURE IN SHIPPING

By

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November 1972

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MARKET AND COST STRUCTURE IN SHIPPING

Zenon S. Zannetos

My presentation will be concerned with some aspects of the tanker markets. I will select certain issues of market and cost structure and try to shed some light on some paradoxes.

If we look at the behavior of those who operate in the tanker markets we will find that history repeats itself. We will observe the same incidence of crises, feast or famine patterns, and the same secrecy or loathness by operators and oil companies to give out data. It seems as if people refuse to learn.

From a selfish point of view I am quite happy that things do not change much because what I described over a decade ago (and to a certain extent Koopmans much before that) is still valid.[1] As an educator and consultant, however, I am very disappointed in that I have not succeeded in convincing many people that the behavior of tanker rates is not as random as it appears to be and that the decision-making processes of those involved in oil transportation can be improved. Meaningful predictions can be made I dare say, and also large fortunes through sound planning.

Recently I received a letter from the Corporate Director for Economic Analysis of one of the largest international oil companies who said that, in reviewing something that I wrote over six years ago, he found that there is a lot of information in it for those with entrepreneurial bend to exploit it very profitably. I am flattered by this, of course, and must admit, no matter how much it hurts my ego, that this is the first and only comment I received from anyone for an effort which took about three years of specific research,

[1] This work appeared later in Zannetos, Zenon S., The Theory of Oil Tankship Rates, M.I.T. Press, 1966. See also Koopmans, Tjalling C., Tanker Freight Rates and Tankship Building, Haarlem, Netherlands, 1939.

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for that piece of work, and many more years of research in this general area before that. But I am also tempted to ask "if it is so, why did it take six years for someone to react to that information."

The reason for this relative apathy in my estimation can be found primarily in a series of misconceptions regarding the economics of the tanker markets. Let me amplify on some of these, by taking as a point of departure the behavior of the oil companies since they are the users of tankers. I hasten to stress, however, that what I am about to say is not presented "from the point of view of the oil companies." It is addressed to all ship owners be they "independents" or oil companies.

Within the oil industry, like in many other organizations, one often finds that what he observes may not be the result of a conscious long-run policy but the outcome of several rather haphazard short-run influences. I must admit, however, that what I call haphazard short-term influences may be nothing more than the consequences of short-run and long-run practices in areas other than transportation within the same organizations. If this is so, then what we are observing are the symptoms of inherent conflicts in the internal policies of the companies which need to be studied, reconciled, and restated. But equally as often one finds that managerial reactions are crisis oriented, and as a result decisions are not made under the best possible circumstances. Policy implications of the actions taken are not evaluated and emotional and symptomatic reactions overtake fundamental causal-diagnostic approaches to problems. It appears that when one is faced with a fire he is wholly consumed in the efforts to put it out and invariably (especially in the glory of his success) he does not ask the necessary questions which will logically lead him to the elimination of the causes of future troubles.

Another point which needs to be stressed is that short-run reactions caused by crises may lead to very undesirable long-run consequences which an outside observer may mistake for the result of conscious application of

long-range policies. For example, I know of companies whose policy has been consistently to own at least 50% of their tonnage requirements. They have not succeeded in reaching this goal nor will they ever succeed in the foreseeable future unless they drastically change their short-run behavior. Some of the specific reasons for this belief will become evident as we proceed.

The most vocal groups within marine transportation departments of oil companies fall into two categories. The 100% ownership group and those who would rather dispense with their marine operations if they could. Those in the first group are questioning the necessity of independent tanker operators and of independent markets. "If it is worthwhile, for the independents to own tankers," they ask, "why not for the oil companies?" The second group includes all those who believe that tanker operations are unprofitable and that the oil companies must put their money in production, refinery and marketing operations. "Our business," they argue "is in oil, not transportation. The latter is a necessary evil. We do not make any money there."

1. Are the Independents Needed?

I will now address myself to the arguments of the first group, that is to say the people who wish to see their companies acquire enough tonnage to cover 100% of their needs. In doing so I will concentrate on the particular aspects of this issue which relate to the overall independent market rather than the specific ownership strategy of any one individual or organization.[2]

In order to answer the question posed one must look into the fluctuations in the demand for transportation. Obviously if the demand for transportation facing each and every firm could be predicted with certainty and provided that there were no fluctuations in such demand over the relevant planning

[2] One must realize that if a strategy is optimal for one organization if it were to act alone, that same strategy may prove disastrous if all competitors were to follow it simultaneously.

horizon,[3] ownership to the full extent of one's requirements could be justified.[4] If, on the other hand, there is uncertainty in the demand facing any particular oil company, then a different ownership percentage, either greater or less than the expected value of the requirements, may be warranted.

The critical data to watch, before expressing a judgment on the necessity of an independent market, are the covariations in the transportation needs of the oil companies or users. If the dominant relationships are negative, that is to say if an increase over planned requirements for one user is associated with preponderantly lower than planned requirements for the rest, then "centralized" solutions are very likely to be required for overall market efficiency. Positive covariations would in all likelihood favor "decentralized" solutions.[5]

My most recent analysis of the transportation requirements of several major oil companies indicates negative dominance. This provides empirical support for certain theoretical inferences regarding markets with inelastic demand schedules which I made quite a few years back.[6] Under these circumstances, it would be very inefficient if all users were to attempt to acquire enough capacity to satisfy all their needs (i.e., minimize the probability of depending on someone else). The tanker market in this case serves the

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[3] The relevant planning horizon must be extensively longer than the time needed to dispose of or acquire vessels. The length of this horizon must be also known with certainty. So for all practical purposes we are talking about a "steady state" situation.

[4] Provided, of course, that the oil companies are as efficient as the independents.

[5] These are rather simplistic statements for a host of complex issues. For the reasons behind these arguments see: Zannetos, Zenon S., "On the Theory of Divisional Structures: Some Aspects of Centralization and Decentralization of Control and Decision Making," Management Science, December 1965, Vol. 12, No. 4, Series B, pp. 49-69; and Zannetos, Zenon S., "Measuring the Efficiency of Organization Structures: Some Implications for the Control System of the Firm," Sloan School Working Paper No. 117-65.

[6] Zannetos, Zenon S., The Theory of Oil Tankship Rates, op. cit., pp. 184-185.

useful purpose of relatively normalizing the fluctuations and reducing risks in the sense that the total fluctuations in the market as measured by net demand and net supply are less than the sum of the absolute fluctuations in individual requirements[7]. The net result is that the market can support the needs of all users with a smaller tonnage than the users would need if they were to be independent of such a market. In this lies the economic justification of an industry-wide reconciliation mechanism which is presently performed by a free tanker market.

One may legitimately ask, however, two further questions:

(a) Could the oil companies through a central agency achieve the same beneficial results?

(b) Is the present ownership optimal?

Assuming away any central agency costs in excess of market costs, the answer to the first question is a "qualified yes". Given a dominance of negative covariations one could theoretically support the proposition that any central agency, if efficiently run, is likely to achieve the same results as the independent market. Personally, I do not expect to see the independent market supplanted mainly for the following reasons.

(i) It is very unlikely that the Anti-trust Division of the United States Department of Justice will allow U.S. firms to be a party to such an arrangement in the foreseeable future.

(ii) The major oil companies in all likelihood would be reluctant to give away what they perceive as a potential monopsonistic privilege.[8]

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[7] I must stress that one must be careful in selecting the time periods at which measurements are taken so that mismatching of behaviors does not occur. In the tankship markets one needs to be particularly careful since there is evidence of dynamic impacts mainly due to price-elastic expectations.

[8] Although some oil companies could exert some monopsonistic pressure on the tanker market, several factors mitigate such an impact. For one, there are several large users of tanker capacity. Furthermore, there is a serious question as to whether the large integrated oil companies consider depressed tanker rates desirable.

By accepting the mechanism of a central agency they will be in effect exchanging interactions with an anonymous competitive market for dicta from an imperfect bureaucracy. I am sure that all of you are aware of the political and economic problems created within organizations by internal (centrally determined) capacity allocations and transfer-price mechanisms.

(iii) The smaller oil companies will not probably find it to their advantage to succumb to such an arrangement either. Their relative bargaining power is potentially far greater if they were to deal with an independent free market rather than with one which is administered for and in all likelihood subservient to the major oil companies.

(iv) The economies of scale accrue with the increase in the size of the vessel, but not so much with the increase in the number of vessels in a fleet. It makes sense, therefore, to treat each vessel as an entity or a firm. This further dilutes the potential monopsonistic power of the major oil companies and strengthens the arguments in favor of the efficiency of a competitive market.

One need not be concerned that the increase in the size of tankers will destroy the workings of the free market mechanism. Even if it were possible to use all VLCCs, with the present transportation requirements one would need over 350 tankers of 500,000 DWT size to satisfy the demand. We must stress, however, that trade restrictions, harbor and channel limitations, wide ranges in refining capacities and varying market requirements impose a wide range in the size distribution of the tanker fleet and therefore market segmentation and relative overall market imperfections.

To repeat then, the independent market serves us very well in allocating tankers to the various users in the short run. In addition, it serves us well for the long run. Without such a free market mechanism it is unlikely that we would have had such a great surge toward tankers of ever larger sizes. While in 1946 the 16,500 DWT vessel was the "queen of the seas" today shipyards are building 500,000 tonners and designing tankers of 1,000,000 tons deadweight. At a time when the average size of all tankers over 10,000 DWT is still below 50,000 DWT, ninety percent of all vessels on order are over 125,000 DWT each and 83% over 200,000 DWT each.

Let me now turn briefly to the question of the degree of ownership of tankers by oil companies. The present ownership of the oil companies is around 34% of all tonnage. I do not believe that it is optimal and know of no one who claims that it is. I frankly believe that the oil companies are bypassing opportunities in the tanker transportation for reason that I will soon mention. They can increase their ownership considerably and profitably before they reach the critical point of destroying the competitive aspects, especially on the supply side, of the free market.

2. Are Tanker Operations Unprofitable?

I feel that questioning the profitability of tanker operations is like insulting the managerial astuteness of the many successful independent tanker owners and closing one's eyes to compelling evidence to the contrary. It is not uncommon, however, to find executives of oil companies who shake their heads in disbelief as to "how the independents do it."

The major reasons for the misconception regarding the profitability of tanker operations lie in the spot rate. Many people do not appreciate the real significance of the spot market.

If we look at the results of the chartering practices of the major oil companies we will notice that over a spot-rate cycle between 82 and 94% of all the oil is carried on vessels which are either owned or chartered on a long-term basis. So the spot market handles only 6 to 18% of all tonnage, usually represented by vessels of the smaller sizes. The significance of the spot rate, therefore, is not so much because of its total direct contribution to the overall cost of oil transportation but because (a) it reflects certain aspects of the economic laws of short-run supply and demand and (b) it influences the expectations of those operating in the tanker markets regarding the future, and therefore affects the number, cost and duration of time charters, and the backlog of tonnage on order, the level of shipbuilding activity and the cost of building tankers.[9]

I wonder how many of you would be surprised to find out that it is quite probable for the weighted average spot rate for a vessel over its lifetime to be below the full cost of that vessel. This does not necessarily imply that the vessel was a bad investment, however. In fact there are many happy original owners of such vessels. The reason for this paradox is that most of the lifetime of vessels is occupied by timer charters. Once the total investment in a tanker is recovered, with an appropriate return thereon, that vessel "can afford" to operate as long as it covers its out-of-pocket costs and contributes something to the owner. The relationship between short-term and long-term rates is such that an astute independent can make it work to his advantage.

In order to determine the impact of such time charters, I took all those consummated during 1968 and calculated the spot rate the chartered vessels would be able to accept upon termination of the time charters and still earn

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[9] For more on this see: Zannetos, Zenon S., The Theory of Oil Tankship Rates, op. cit.; also Zannetos, Zenon S., "Time Charter Rates," Sun Oil Company, Analysis of World Tank Ship Fleet, 25th Anniversary Issue, August 1967.

8% after taxes over their total lifetime.[10] The resulting spot rates ranged between Worldscale 18 1/2 and 27 with a mean of 21 1/2 (in terms of 1968 costs of operation).

3. Is Ownership of Tankers a Risky Business?

Many executives of oil companies are looking at the time-pattern of spot rates and argue that owning tankers "is a risky business." And this argument is made even at times when banks are willing to loan between 80 and 90% of the cost of new tankers and be assured that their money can be fully recovered from the net time-charter hire of the "newbuildings."

We have already pointed out that only a small percentage of tonnage operates in the spot market. During high spot rates this market represents only between 6 and 8% of available capacity. So we are looking at the tail end of a statistical distribution. But more critical here is the distinction between the risk inherent in the total industry versus that reflected in the policies of a firm or in the type of operations chosen for a vessel.[11]

Although there are differences in the riskiness of alternative policies there is no risk to speak of in the total market. In fact, I know of few industries which are less risky than the oil tankship transportation industry, especially if we look at it from the point of view of a large user of capacity. Relatively predictable total requirements, time-charter agreements, and, because of the latter, availability of capital mitigate the risks involved in the industry.[12]

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[10] This was a good year for rates but not as good as 1967 or 1970. Also we must stress that many vessels accept several time charters. The average is slightly over two.

[11] For all practical purposes the vessel is the firm as far as the independents are concerned.

[12] I am not referring to political or ecological risks. Those of the latter which are insurable are reflected in the operating costs of the vessels. The insurance costs change significantly with size. For example, insurance premiums represent approximately 10% of the operating costs of a 20,000 ton vessel but 45% of the respective costs of a 230,000 tonner, both if operating under non U.S. registry.

The misconception regarding the risks involved influences adversely the performance of oil companies on two other counts (a) the degree of trading on the equity and (b) the return on investment requirements imposed on tankship capital budgets.

(a) Trading on the Equity: If we analyze the balance sheets of the major oil companies we will find that over the last ten years their Debt to Equity ratio has fluctuated around 14%. In contrast the comparable figure for the majority of the independents for the same period has been close to 90%. That is to say on the average about 12% of the total capital (assets) of oil firms came from borrowing and the rest or 88% from equity and for the independents 47% from borrowing and 53% from equity. Because of these differences in practices what would normally give, let us say, an 8% return on investment after taxes to independents will only provide 5.6% to oil companies.[13]

The motivation behind the predominantly equity financing of oil companies is a mistaken belief that it is "both cheaper and safer" not to borrow. We can show that if a certain method of financing is not cheaper than another it is also not safer in the long-run. Only short-run safety may be bought. What is more it is very very questionable to claim that the cost of equity capital of the oil companies is as low as 6 to 7% before taxes that the independents pay to borrow. And if the independents can borrow why not the oil companies.

Although I know the perils of prediction, I venture to say that the major oil companies will do more borrowing in the future. And this not so much because they realize the inadvisability of their previous behavior but because the financial markets (investment bankers and underwriters) will force them to do so. Equity capital in other words will be drying up gradually

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[13] See Appendix I.

as far as the oil companies are concerned. This will force more explicit recognition of the real cost of capital to the oil industry, especially for those firms which are heavily involved in "foreign" operations.

(b) Return on Investment Requirements: In contrast to the arguments of low equity costs presented to support equity financing are the practices of requiring 25 to 35% return on investment before taxes for tankers. These practices are not only inconsistent but outright dangerous. It can be proven that a policy of not segregating projects according to the risks inherent in them and of imposing, as a result, return on investment requirements reflecting the overall average risk in the total portfolio of the firm, will lead the firm out of the less risky business. This in turn will encourage the subsidization of risky projects which in the long-run will drive the firm to bankruptcy.

Another point that I wish to make regarding the risk involved in tankship ownership is that the analysis which I performed back in August 1967[14] showed that a decrease in the "certainty of full employment" from 1.00 to .75 had a lower overall impact on the time-charter rates (of long-run duration) than did the loan-value of the charter. The liberal loan terms which the banks gave the independents, and enabled them to "trade on the equity" effectively, were made possible by the assumption of the risks inherent in the venture by the oil companies themselves. A time charter in effect shifts the risks of unemployment and underemployment, for the period of its duration, from the owner to the charterer. So when the oil companies are talking about riskiness in the ownership of tankers, I wonder whether they realize that they may be effectively carrying the risk and also paying the risk premium to the owners.[15]

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[14] See Zannetos, Zenon S., "Time Charter Rates," op. cit., Table 9.

[15] I am not talking here about "risks" covered by insurance, escalation clauses, union problems or taxation. I am talking about average risks inherent in the industry.

4. Is There Any Competitive Advantage in the Raw Operating Data?

Another paradox I wish to attack refers to the secrecy in which both oil companies and independents indulge. They erroneously believe that the raw data themselves are the repository of a competitive advantage. I was shocked during my initial contacts with the industry to find out that even the reports of tanker brokers which were dusting in vaults of companies somehow were considered as part of proprietary and sacred information.

One major reason for the secrecy, in many cases, is the inability of those who possess the data to use them for managerial decisions. Any mention of potential use by someone else, therefore, is considered as a threat.

Obviously, the availability of data is necessary but not sufficient for success. What is more important is the logical analysis imposed on data. Little do the operators and oil firms realize that their competitors have the data. So from whom are they trying to protect themselves, the academicians? We cannot hurt them, in fact, we are likely to help them if they were to give us more information.

What I plead is for better analytical models and better data to support managerial decisions. Intuition is great, but intuitive solutions must be tested for validity.[16] For this we need both good models and the necessary input data. But I dare say that data without any models, to provide the appropriate context, are completely useless because there is no meaning in themselves. On the other hand, models without the appropriate data although devoit of specific operational content can at least provide some value because these allow the user to test some theoretical hypotheses with fictitious data.

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[16] Given a fleet of small and large tankers, how many people, for example, would intuitively accept that there are certain tanker sizes and runs for which it is better to assign the larger tankers for the shorter runs and the smaller tankers for the longer runs. For resolution of this paradox one must look at the relative advantages of the larger over the smaller tankers during periods of idleness versus running. Note that as posed, this is an overall cost minimization problem.

5. Chartist Trends Versus Fundamental Analysis

The tanker markets over the years have been influenced much more by short-run extrapolations than by fundamental long-run analysis. Any temporary downturn or upturn is used for predicting surpluses or shortages of tonnage. In many cases this type of behavior leads to self-confirmations in the short-run and delays the workings of economic processes which tend to restore an equilibrium. Thus the peaks and valleys of the rate cycles are accentuated and their duration prolonged.

Many people are looking at the present costs of shipbuilding and operation and wonder what is in the future. If we look at the changes which occurred since 1966 we find that shipbuilding costs increased by about 80% and operating costs by over 100%. Taking, for instance, a 250,000 DWT tanker which according to my calculations could earn at least[17] 8% return on investment at Worldscale 23.5 back in 1966, if it were to be built today, and given the present financing and operating costs, it would require about Worldscale 50.8.[18] A 500,000 DWT tanker would earn at least 8% on investment at present costs at about Worldscale 42.2. I must warn, that I do not have much confidence in my current cost data because my observations are precious few.

The question is: Would these costs remain at these levels? My answer is no! If we look at history we can find ample support for this answer. Economies of scale still accrue with vessel size and the impact of these on the "existing" fleet will be continuously felt. If we now see a flattening of the average cost curves for vessels beyond 500,000 DWT it is only temporary. We saw the same phenomenon for vessels beyond 75,000 DWT back in 1958 and beyond

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[17] Depending on the degree of trading on the equity and the size of the vessel. My model in addition to being flexible regarding financing arrangements imputes part of the benefits of size of the particular vessel as compared to the "marginal vessel" to the owner of the tanker.

[18] My estimates seem to agree more with Platou than with Walter L. Newton whose cost estimates are Worldscale 28.5 and 60.0 respectively. However, our results are not comparable because our models are different.

250,000 DWT in 1966. Analysis of what occurred in the past, convinces me of this. Let us not underestimate the pressure of technology not only in the areas of tankship building and tankship operation but also in ancillary areas. The net result of this pressure is a long-term downward shift in the cost curves of the industry. Inflation no doubt will eat up some of these benefits but not to the point where the present cost levels can be justified in the long run. In fact, I already see signs of softening shipbuilding prices.

If anyone is expecting the wide fluctuations in tanker rates to disappear, he will be extremely disillusioned. What I have just said refers to the long-run average cost of tanker transportation. Crises we will have with or without "Suez Canal incidents." In fact, the preconditions are now set for other crises in the future. The way we handle these crises will for the most part determine the severity, timing and duration of further future crises. Those who operate in the tanker markets, both the independents and the oil companies, must be careful not to let a crisis distort long-range plans but rather look into the latter for clues as to how they can best handle the short-run. And clues we have plenty.

Let me close then by expressing confidence that the operations in the tanker markets are tractable and amenable to sound analytical techniques. We can effectively use better models and better input data. But above all what we need is more logic and less emotion.

EXHIBIT I

Trading on the Equity

The formula for trading on the equity is as follows:

$$R_E = \left[R_A + \frac{(R_A - i)\, D}{E} \right] (1 - \text{tax rate})$$

Where R_E = return on equity after tax

R_A = average return on total assets before interest and tax payments

i = the effetive interest rate on the total liabilities

D = the amount of debt both current and long term

E = the amount of equity

$D + E$ = total assets or total investment (I)

Notes:

1. The above is a hyperbolic function with an asymptote at D = total assets (I); when $R_A = i$ then $R_E = R_A$.

2. We assume that i is independent of the Debt/Equity ratio which of course, although valid up to a point, is not valid as D approaches I. Eventually i becomes a function of the Debt/Equity ratio and overcomes R_A as shown by the dotted lines in the following figure.

3. The greater the difference between R_A and i the steeper the slope of the R_E curves for both $(R_A - i)$ 0 and $(R_A - i)$ 0

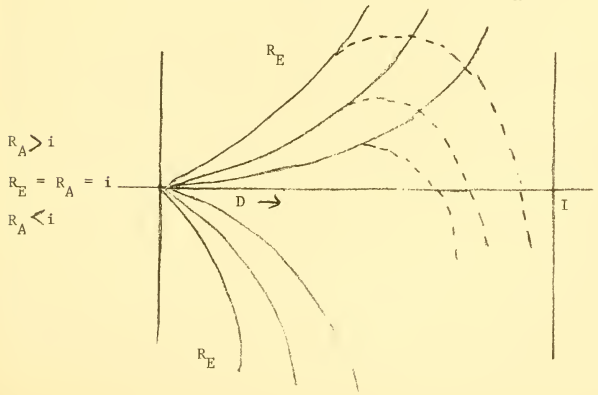

EXHIBIT II

Comparative Spot-Rate Equivalents
For A Minimum of 8% Return on Investment

Size of Vessel	1966	1971-1972
45,000 DWT	$6.184	$8.06
100,000	3.493	6.30
150,000	2.584	4.94
200,000	2.325	4.83
250,000	2.152	4.66
300,000	2.066	4.62
350,000	1.933	4.25
500,000		3.87

For a 250,000 ton vessel the necessary rate increased from Worldscale 23.47 in 1966 to 50.8 in 1971-1972. For the 500,000 ton vessel the 1971-1972 rate is equivalent to Worldscale 42.2

Based on a Mina Al Ahmadi/Rotterdam run (Worldscale 100 = $9.17)

Notes: With the exception of the 45,000 DWT vessel which was considered as the marginal vessel all other sizes of tankers earn more than 8% return on investments with the above rates. As mentioned in the text the model used is quite flexible and complex imputing certain economies of scale to the ship owner.

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